



Cornell University



Integrated Pest Management

Apple chlorotic leaf spot virus

Elizabeth Cieniewicz and Marc Fuchs

Section of Plant Pathology and Plant-Microbe Biology,
School of Integrative Plant Science, Cornell University,
NYSAES, Geneva, NY

Introduction

Apple chlorotic leaf spot virus (ACLSV) infects pome and stone fruits. It can elicit diverse symptoms although, in most cultivars the virus is latent, which means that infected trees do not manifest observable symptoms. *Apple chlorotic leaf spot virus* is often detected in co-infection with other latent viruses such as *Apple stem pitting virus* (ASPV) and *Apple stem grooving virus*. *Apple chlorotic leaf spot virus* can have a devastating effect on apple growth and productivity.

Disease and Causal Agent

Implicated in several diseases of pome and stone fruits such as apple top working disease, apple russet ring disease, and pear ring pattern mosaic, ACLSV is one of the most widely distributed viruses of fruit trees. It is present in cultivated, ornamental and wild species of the Rosaceae. In addition to apple, ACLSV affects pear and quince, and stone fruits like peach, plum, apricot, and cherry. Although ACLSV exhibits latent infection in most trees, it causes symptoms of variable severity in susceptible cultivars, certain scion/rootstock combinations, or in co-infection with other latent viruses. This virus has a single-strand positive-sense RNA genome that is encapsulated in flexuous filamentous-shaped particles. A high degree of genetic variability exists among isolates of ACLSV.



Figure 1. Declining Red Delicious/G.935 trees infected with *Apple chlorotic leaf spot virus* (ACLSV) and *Apple stem pitting virus* (ASPV) in a nursery in fall 2015. The budwood used for grafting was the source of the two viruses. Note the stunted growth, browning of leaves, reduced terminal growth or terminal dieback of six infected trees (left of the wooden post) compared to seven healthy trees (right of the wooden post). Photo credit: D. I. Breth and E. M. Tee.

Symptoms and Impact

Pome fruits

One of the first described viral diseases of apple, top working disease, is associated with ACLSV infection of the scion. Following budding, ACLSV translocates from a latently infected scion to a susceptible rootstock, resulting in a decline of grafted trees, generally 1-2 years after trees are top grafted. Tree decline can result from ACLSV infection alone or in association with another latent virus such as ASPV (Figure 1). Apple russet ring disease, in which yellow rings appear on foliage and russet rings appear on fruits, may result from ACLSV infection. Symptomatic fruits are unmarketable. In susceptible apple cultivars, foliar symptoms can include chlorotic leaf spots and line patterns, premature leaf drop, stunting, terminal dieback, blackening (necrosis) of inner bark and local bark necrosis around grafted, diseased buds. Up to 30% reduction in yield has been reported for ACLSV in combination with other latent viruses. Additionally, pear ring pattern mosaic symptoms may also be attributed to ACLSV.

Stone fruits

In stone fruits, some isolates of ACLSV can elicit foliar and fruit symptoms. Trunk symptoms are rare, but certain apricot cultivars can exhibit graft incompatibility and bud necrosis in association with ACLSV infection. Some ACLSV isolates can induce bark splitting in plum, leaf deformation and chlorosis in peach, and fruit necrosis, decline, and bark splitting in cherry.

Spread

Apple chlorotic leaf spot virus is disseminated through vegetative propagation, grafting and top working. There is no evidence of vector-borne, seed-borne, or pollen-borne transmission, although the virus can be mechanically

transmitted, with some difficulty, from infected pome and stone fruit hosts to experimental herbaceous hosts. Therefore, the widespread distribution of ACLSV in pome and stone fruit trees worldwide has resulted from unintentional and careless use of scion budwood collected from infected trees for propagation or top working, and from infected rootstock liners. The absence of obvious symptoms on most infected trees increases the risk of unintentional propagation and distribution of ACLSV-infected stock.

Management

Like other viruses of woody crops, there is no cure for ACLSV in an established orchard and there is no direct measure to combat the virus besides removing infected trees. The best way to control the virus is to prevent its introduction in new orchards. Since ACLSV is latent in many cultivars and can be transmitted via grafting, the use of infected propagation material is culpable for most infections. A careful selection of clean, virus-tested (negative) planting material and budwood used for top working is the best method of preventing the introduction of ACLSV into new orchards. To ensure a healthy, long-lived orchard producing good yields and high quality fruit, only trees derived from clean, virus-tested buds and rootstock liners should be planted.

Propagation material should be sourced only from clean, virus-tested trees to prevent the dissemination of ACLSV. Laboratory tests such as serological assays and nucleic acid-based assays, including reverse transcription polymerase chain reaction (RT PCR), can reliably identify ACLSV in apple and facilitate the identification of clean propagation material. Therapeutic methodologies such as heat- and chemotherapy can be used in the laboratory to regenerate clean propagation material.